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REMARKS

Independent claims 1, 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41 and 44 have been amended to positively recite that the aperture ratio avoids the diffusion of the second gas from the processing region to the plasma generation region. Support for these claim amendments is found, for example, in pages 8-9 of the specification.

The art rejections are respectfully traversed. Considering the rejection of claims 1, 2, 4, 11, 13, 14, 16, 23, 25, 26, 28, 35, 37, 38 and 40 under 35 USC §103 as obvious over Yuda (Japanese Publication No. 11-168094), and the rejection of claims 5, 7, 8, 10, 17, 20, 22, 29, 31, 32, 34, 41, 43, 44 and 46 under 35 USC §103 as obvious over Yuda in view of Sameshima et al. (U.S. Patent No. 5,304,250), as noted in Applicants' previous Amendment, which is incorporated by reference, nowhere does Yuda teach a flow-back phenomenon of silane gas into a plasma generation region, or prevention of such a flow-back phenomenon.

In cipher 3 of the Action, the Examiner states:

> With respect to the chamber pressure, it is inherent that the pressure in the plasma generation region 6 is higher than in the processing region 10 to suppress backward flow of the second gas into the plasma generation region because otherwise the gases would not flow downward. As seen in Figure 8, since gas inlet 5 is in the top of the chamber 16 and exhaust 15 is in the bottom of the chamber a pressure drop is created from the top (plasma generation region 6, i.e. higher pressure) to the bottom (processing region 10, i.e. lower pressure) of the chamber which allows the gases from the plasma generation region to flow downward. Additionally, since the exhaust 15 is located in the bottom of the chamber 16 all of the gases will be drawn downward, as indicated by arrows, and not upward, hence the prevention of flow-back phenomenon is achieved.

However, the present inventors have found that the flow-back phenomenon of the silane gas (second gas) occurs from the processing region 10 to the plasma generation region 6, even

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when evacuation occurs in processing region 10. Moreover, the present inventors have ascertained the causes of such a flow-back phenomenon and proposed a way to prevent the occurrence of the flow-back phenomenon.

According to the inventors' experimental studies, it has been found that the flow-back phenomenon depends on an aperture ratio of perforated holes formed in a plate between a plasma generation region and a processing region. Under the circumstances, the aperture ratio of the perforated holes in the above-mentioned plate is selected so that the flow-back phenomenon does not take place.

On the other hand, neither Yuda nor Sameshima et al. (U.S. Patent No. 5,304,250) teaches a flow-back phenomenon of silane gas from the processing region 10 to the plasma generation region 6 and the causes of such flow-back phenomenon. Thus, it is clear that the present invention teaches a novel approach to the prevention of the flow-back phenomenon.

Specifically, it is to be noted in the present invention that oxygen gas (namely the first gas) is introduced into a plasma generation region 12, while a silane gas (the second gas) is directly introduced into a substrate processing region 13 (FIG. 1). Each of the first and second gases has a flow rate and a concentration (or density). Thus, the plasma apparatus according to the present invention forms a multi-component system, not a single component system. The Examiner's assumption would be true in connection with the single component system.

On the other hand, the inventors have found that each of the first and the second gases is independently diffused in the multi-component system in accordance with Fick's law that is known in the art and that is defined, for example, in McGraw-Hill Dictionary of Scientific and Technical Terms (Fifth Ed.), page 748 (copy attached). This is because each component, such

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as the second gas, in the multi-component system, is diffused from a high density portion to a low density portion until each component finally becomes a uniform distribution in a space. Herein, the second gas (silane gas) has a high density at a portion adjacent to the plate 40 as compared to the plasma generation region 12 and might objectionably flow through the perforated holes 41 formed in the plate 40 into the plasma generation region 12, as long as the perforated holes 41 are not adjusted.

As a result, the second gas is diffused not only into the substrate processing region 13, but also into the plasma generation region 12. If the aperture ratio of the perforated holes 41 formed in the plate 40 is not selected at an adequate value in accordance with Fick's law, such diffusion of the second gas into the plasma generation region 12 brings about the flow-back phenomenon.

In order to avoid the diffusion of the second gas into the plasma generation region 12 from the substrate processing region 13, the present inventors have made certain that the flow rate of, for example, oxygen radicals, from the plasma generation region 12 is higher than a diffusion velocity of the second gas diffused from the substrate processing region 13 through the perforated holes 41 into the plasma generation region 12.

The above-mentioned condition has been accomplished in the present invention by keeping a pressure difference between the regions 12 and 13 at a high value in order to avoid the flow-back phenomenon of the second gas (specification, page 9, lines 3-7).

Thus, the present invention teaches a way of enlarging the pressure difference between the regions 12 and 13 by selecting the aperture ratio of the perforated holes formed in the plate

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40. Thus, no combination of Yuda and Sameshima et al. could achieve or render obvious the instant invention.

In the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our Deposit Account Number 08-1391.

Respectfully submitted,

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JUN 14 2004
PATENT & TRADEMARK OFFICE

Serial No. 09/820,149
Docket No. NEC WNZ-2310

Submitted with
AMENDMENT E

Excerpt from
McGraw-Hill Dictionary of Scientific and Technical Terms
(Fifth Ed.), page 748


McGRAW-HILL
DICTIONARY OF
SCIENTIFIC AND
TECHNICAL
TERMS
Fifth Edition

tively uncoiled double-stranded deoxyribonucleic acid thought to be regions of specific base sequences for coding rather than gene control. { 'fī,brȯid dē,ōk·sē,rī·bō·nü'klē·ik 'as·əd }

fibroid tumor *See* fibroma. { 'fī,brȯid 'tü·mər }

fibroin [BIOCHEM] A protein secreted by spiders and silkworms which rapidly solidifies into strong, insoluble thread that is used to form webs or cocoons. { 'fī·brə·wən }

fibrolite *See* sillimanite. { 'fī·brə,līt }

fibroma [MED] A benign tumor composed primarily of fibrous connective tissue. Also known as fibroid tumor. { fī'brō·mə }

fibroma molluscum *See* neurofibromatosis. { fī'brō·mə mə'ləs·kəm }

fibromatosis [MED] 1. The occurrence of multiple fibromas. 2. Localized proliferation of fibroblasts without apparent cause. { ,fī·brō·mə'tō·səs }

fibromyoma [MED] A benign tumor, usually of smooth muscle, with a prominent fibrous stroma; commonly a uterine leiomyoma. { ,fī·brō·mī'ō·mə }

fibromyositis *See* myositis. { ,fī·brō,mī·ə'sīd·əs }

fibronectin [BIOCHEM] A type of large glycoprotein that is found on the surface of cells and mediates cellular adhesion, control of cell shape, and cell migration. { ,fī·brə'nek·tən }

fibroplasia [MED] The growth of fibrous tissue, as in the second phase of wound healing. { ,fī·brə'plā·zhə }

fibrosarcoma [MED] A sarcoma composed of spindle cells that produce collagenous fibrils. { ,fī·brō·sär'kō·mə }

fibrosing adenomatosis *See* sclerosing adenomatosis. { fī'brō·siŋ ,ad·ən,ō·mə'tō·səs }

fibrosis [MED] Growth of fibrous connective tissue in an organ or part in excess of that naturally present. { fī'brō·səs }

fibrositis [MED] Inflammation of white fibrous connective tissue, usually in a joint region. { ,fī·brə'sīd·əs }

fibrous composite [MATER] A composite material consisting of fibers embedded in a matrix. { 'fī·brəs kəm'päz·ət }

fibrous dysplasia [MED] 1. Extensive formation of fibrous tissue and transformation of bony tissue in one or more bones. 2. Development of abnormal amounts of fibrous tissue in the mammary glands. { 'fī·brəs dis'plā·zhə }

fibrous fracture [MECH] Failure of a material resulting from a ductile crack; broken surfaces are dull and silky. Also known as ductile fracture. { 'fī·brəs 'frak·chər }

fibrous ice *See* acicular ice. { 'fī·brəs 'īs }

fibrous osteoma *See* ossifying fibroma. { 'fī·brəs ,äs·tē'ō·mə }

fibrous plaster [MATER] Gypsum plaster reinforced or backed with sisal or canvas. { 'fī·brəs 'plas·tər }

fibrous protein [BIOCHEM] Any of a class of highly insoluble proteins representing the principal structural elements of many animal tissues. { 'fī·brəs 'prō,tēn }

fibrous structure [MATER] A ropy surface on a fractured material. [MET] 1. A lamination on an etched section of a forging. 2. In wrought iron, a structure consisting of slag fibers embedded in ferrite. { 'fī·brəs 'strək·chər }

fibula [ANAT] The outer and usually slender bone of the hind or lower limb below the knee in vertebrates; it articulates with the tibia and astragalus in humans, and is ankylosed with the tibia in birds and some mammals. { 'fib·yə·lə }

ficin [ORG CHEM] A proteolytic enzyme obtained from fig latex or sap; hydrolyzes casein, meat, fibrin, and other proteinlike materials; used in the food industry and as a diagnostic aid in medicine. { 'fī·sən }

Fick's law [PHYS] The law that the rate of diffusion of matter across a plane is proportional to the negative of the rate of change of the concentration of the diffusing substance in the direction perpendicular to the plane. { 'fiks ,lȯ }

fictitious [NAV] Pertaining to or measured from an arbitrary reference line as in fictitious equator, fictitious latitude, or fictitious longitude. { fik'tish·əs }

fictitious craft [NAV] In marine usage, an imaginary craft used in the solution of certain maneuvering problems, as when a ship to be intercepted is expected to change course or speed during the interception run. { fik'tish·əs 'kraft }

fictitious equator [NAV] A reference line serving as the origin for measurement of a fictitious latitude. { fik'tish·əs i'kwād·ər }

fictitious graticule [NAV] A graticule formed from a set of fictitious parallels and meridians to resemble the geographic graticule but offset from it; coordinates taken from the fictitious graticule are used with a transverse or oblique [illegible] or with a navigation grid. { fik'tish·əs 'grad·ə,kyül }

fictitious latitude [NAV] Angular distance [illegible] as shown on a fictitious graticule. { fik'tish·əs [illegible]

fictitious longitude [NAV] The arc of the [illegible] the prime meridian and any given meridian [illegible] fictitious graticule. { fik'tish·əs 'län·jə,tüd }

fictitious loxodrome *See* fictitious rhumb line. { 'läk·sə,drōm }

fictitious loxodromic curve *See* fictitious [illegible] { fik'tish·əs ,läk·sə,drōm·ik 'kərv }

fictitious meridian [NAV] One of the coordinates [illegible] tious graticule. { fik'tish·əs mə'rid·ē·ən }

fictitious parallel [NAV] One of the coordinates [illegible] a fictitious graticule. { fik'tish·əs 'par·ə·lel }

fictitious pole [NAV] One of the two points [illegible] equator on a fictitious graticule; called transverse pole, depending upon the type of fictitious equator. { fik'tish·əs 'pōl }

fictitious rhumb line [NAV] A line on a fictitious [illegible] making the same oblique angle with all meridians [illegible] as fictitious loxodrome; fictitious loxodromic curve. { fik'tish·əs 'rəm ,līn }

fictitious ship [NAV] An imaginary ship serving as [illegible] craft. { fik'tish·əs 'ship }

fictitious vehicle [NAV] An imaginary vehicle [illegible] fictitious craft. { fik'tish·əs 'vē·ə·kəl }

fictitious year [ASTRON] The period between [illegible] turns of the fictitious mean sun to a sidereal hour [illegible] (right ascension 18 hours 40 minutes; about [illegible] length of the fictitious year is the same as that [illegible] year, since both are based upon the position of [illegible] respect to the vernal equinox. Also known as [illegible] { fik'tish·əs 'yir }

Ficus [BOT] A genus of tropical trees in the family [illegible] including the rubber tree and the fig tree. [INV] [illegible] of gastropod mollusks having pear-shaped [illegible] sculptured shells. { 'fī·kəs }

fiddley *See* fidley. { 'fid·lē }

fidelity [COMMUN] The degree to which a system [illegible] reproduces at its output the essential characteristics [illegible] impressed on its input. { fə'del·əd·ē }

fidley [NAV ARCH] Also spelled fiddley. [illegible] above a fire room through which pass ventilation [illegible] work of iron about the ladder of a hatch in a ship [illegible] below the deck. { 'fid·lē }

FIDO [METEOROL] A system for artificially [illegible] which gasoline or other fuel is burned at [illegible] airstrip to be cleared. Derived from fog investigation operations. { 'fī·dō }

fiducial inference [STAT] A type of inference [illegible] is to make probabilistic statements about [illegible] parameters; based on the distribution of [illegible] which the inference is to be made. { fə'dü·shəl }

fiducial limits [STAT] The boundaries within [illegible] eter is considered to be located; a concept in [illegible] { fə'dü·shəl 'lim·əts }

fiducial point [OPTICS] A mark, or one of [illegible] visible in the field of view of an optical instrument [illegible] reference or for measurement. Also known as [illegible] { fə'dü·shəl ,point }

fiducial temperature [METEOROL] That [illegible] which, in a specified latitude, the reading of a [illegible] eter does not require temperature or latitude [illegible] [THERMO] Any of the temperatures assigned [illegible] reproducible equilibrium states on the International Temperature Scale; standard instruments are [illegible] temperatures. { fə'dü·shəl 'tem·prə·chər }

fiduciary point *See* fiducial point. { fə'dü·shē·er·ē [illegible]

fiedlerite [MINERAL] $Pb_5(OH)_2Cl_4$ A colorless [illegible] posed of a hydroxychloride of lead, occurring [illegible] crystals. { 'fēd·lə,rīt }

Fiedler's myocarditis *See* interstitial myocarditis. [illegible] ,mī·ə,kär'dīd·əs }

field [COMPUT SCI] A specified area, such as [illegible] columns or a set of bit locations in a computer [illegible] particular category of data. [ELEC] That part [illegible] motor or generator which produces the magnetic [illegible] reacts with the armature, producing the desired [illegible]



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ISBN 0-07-042333-4

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